39630/RJP/E264

WHAT IS CLAIMED IS:

1. In a communications network, a method of verifying connectivity between network nodes, comprising, for each network node,:

providing periodic time intervals,

counting elapsed periodic time intervals since transmission of a link integrity indication frame,the link integrity indication frame being a frame which, when transmitted by a network node, can be received by all other nodes on the communications network and which contains a source identifier that uniquely identifies a transmitting node;

receiving frames from a sending node and maintaining during each periodic time interval a node state status and a current received frame source identifier;

upon the expiration of a predetermined elapsed time interval determining the node state status and a count of the elapsed periodic time intervals since transmission of a link integrity indication frame; and

transmitting a link integrity indication frame based upon determining:

the count of predetermined elapsed time intervals as being greater than a predefined count limit, and

the node state status as not being indicative of network traffic.

2. The method of Claim 1, wherein the source identifier is a source address and the current received frame source identifier is a current received frame source address.

3. The method of Claim 2, wherein counting the elapsed periodic time intervals includes:

incrementing a counter every time a periodic time interval elapses and the network node has not sent a link integrity indication frame during the elapsed time interval, and

resetting the counter whenever the network node transmits a link integrity indication frame.

4. The method of Claim 2, wherein maintaining a node state status includes:

establishing a node initial state status upon receipt of a frame from another node on the network;

upon receiving a subsequent frame within the predetermined elapsed time interval, comparing the maintained current received frame source address with a subsequent frame source address, and

if the comparing indicates a same source address, the node state status remains unchanged, and

if the comparing indicates a different source address, the node state status changes to being indicative of network traffic and transmitting a link integrity indication frame is suppressed.

5. The method of Claim 2, wherein determining the node state status as not being indicative of network traffic includes

providing a logic state machine having a plurality of states including a down state indicative of a non-functional network link and a plurality of up states indicative of functional network links, the states being transitional therebetween based upon predetermined network node status, expiration of periodic timing intervals and receipt of frames by the network node.

6. The method of Claim 2, wherein maintaining a current received frame source address includes recording the current received frame source address in a memory table.

Sub a2

7. The method of Claim 2, wherein the sending node is a node on a broadcast network.

8. The method of Claim 2, wherein the sending node is a node on a point-to-point network.

9. The method of Claim 2, wherein the communication network is a multi-layer protocol communication network.

10. The method of Claim 9, wherein the transmitting of a link integrity indication frame is performed at a data link layer of the multi-layer protocol communication network.

11. The method of Claim 2, wherein the network nodes whose connectivity is being verified are connected by transmission medium from the group of telephone wire, shielded twisted pair, unshielded twisted pair, cable, power line, optical fiber, or wireless medium.

12. In a communications network, a link integrity apparatus for verifying connectivity between network nodes communicating over a transmission medium, comprising, for each network node,:

a periodic time interval generator;

a counter system for counting elapsed periodic time intervals since transmission of a link integrity indication frame, the link integrity indication frame being a frame which, when transmitted by a network node, can be received by all other nodes on the communications network and which contains a source identifier that uniquely identifies a transmitting node;

Sub A2

a receiver coupled to the transmission medium for receiving frames from a sending node;

a storage system for maintaining during each periodic time interval a node state status and a current received frame source identifier;

logic circuitry coupled to the counter system, the storage system and the receiver, the logic circuitry upon the expiration of a predetermined elapsed time interval determining the node state status and a count of the periodic elapsed time intervals since transmission of a link integrity indication frame; and

a transmitter coupled to the logic circuitry and the transmission medium for transmitting a link integrity indication frame over the transmission medium based upon determining by the logic circuitry that the count of predetermined elapsed time intervals as being greater than a predefined count limit and the node state status as not being indicative of network traffic.

13. The link integrity apparatus of Claim 12, wherein the source identifier is a source address and the current received frame source identifier is a source address.

14. The link integrity apparatus of Claim 13, wherein the counter is incremented by the logic circuitry every time an elapsed time interval expires and the network node has not sent a link integrity indication frame during the elapsed time interval, and the counter is reset whenever the network node transmits a link integrity indication frame.

15. The link integrity apparatus of Claim 13, wherein the logic circuitry maintains node state status by:

establishing a node initial state status upon receipt of a frame from another node on the network;

upon receiving a subsequent frame within the predetermined elapsed time interval, comparing the maintained current received frame source address with a subsequent frame source address, and

if the comparing indicates a same source address, the node state status remains unchanged, and

if the comparing indicates a different source address, the node state status changes to being indicative of network traffic and transmitting a link integrity indication frame is suppressed.

16. The link integrity apparatus of Claim 13, wherein the logic circuitry functions as a logic state machine having a plurality of states including a down state indicative of a non-functional network link and a plurality of up states indicative of functional network links, the states being transitional therebetween based upon predetermined network node status, expiration of periodic timing intervals and receipt of frames by the network node.

17. The link integrity apparatus of Claim 13, wherein the memory storage system includes memory table for maintaining a current received frame source address.

18. The link integrity apparatus of Claim 13, wherein the sending node is a node on a broadcast network.

19. The link integrity apparatus of Claim 13, wherein the sending node is a node on a point-to-point network.

Sub 92

20. The link integrity apparatus of Claim 13, wherein the communication network is a multi-layer protocol communication network.

21. The link integrity apparatus of Claim 20, wherein the transmitting a link integrity indication frame is performed at a data link layer of the multi-layer protocol communication network.

22. The link integrity apparatus of Claim 13, wherein the network nodes whose connectivity is being verified are connected by transmission medium from the group of telephone wire, shielded twisted pair, unshielded twisted pair, cable, power line, optical fiber, or wireless medium.

23. A method of verifying connectivity between interconnected nodes in a network, the method comprising the steps of:

determining when an interval of a first interval timer at a first node expires;

transmitting, from the first node in response to said first interval timer, a data frame addressed to all of said

interconnected nodes, the data frame including an address of said first node;

receiving, by at least one of said interconnected nodes, the data frame; and each one of the receiving nodes then deciding:

that there is connectivity with the network in general; and

that, based on the address of the first node, a connection with the first node is functional.

Sub 92

24. The method of Claim 23, further comprising the steps of:

determining when an interval of a next interval timer at a next node expires;

transmitting, from said next node in response to said next interval timer, a data frame addressed to all of said interconnected nodes in the network, the next data frame including an address of the next sending node;

at least one of said interconnected nodes receiving the data frame; and each one of the receiving nodes then deciding, based on the address of the next node, that a connection with the next node is functional.

25. The method of Claim 23, wherein the receiving step further comprises recording the address of the first node in a table.

26. The method of Claim 24, further comprising the steps of:

recording the addresses of the first node and the next node in a table; and

comparing the address of the next node with the address of the first node.

27. The method of Claim 26 further comprising the step of each one of the receiving nodes suppressing transmission of a data frame for a predetermined number of intervals.

28. The method of Claim 26 further comprising the steps of:

each one of the receiving nodes receiving data frames from each of the other interconnected nodes until the address of each of said interconnected nodes is recorded; and

each one of the receiving nodes then deciding, based on the addresses received from of each of said interconnected node, that the network of said interconnected nodes is functional.

29. The method of Claim 24 further comprising the steps of:

each one of the nodes that does not receive the data frame waiting a predetermined number of intervals; and

upon not receiving any data frames, then deciding that a connection in the network of said interconnected nodes is down.

30. The method of Claim 23 wherein the data frame comprises a data-layer header that includes the address.

31. The method of Claim 30 wherein the data frame includes a message.

32. The method of Claim 30 wherein the data frame further comprises a destination address.

33. The method of Claim 32 wherein the destination address is a broadcast address.

34. The method of Claim 32 wherein the destination address is a multicast address.

35. A system for verifying connectivity in a network, comprising:

a plurality of interconnected nodes, each node including:

an independent interval timer;

Sub a7

a data frame transmitter, responsive to the interval timer, the data frame being addressed to all other nodes in the network and containing at least a source address;

a data frame receiver for receiving said data frames from other interconnected nodes in the network; and

logic means, responsive to the receiving means, for deciding, via a source address in a received data frame, whether a connection between a node corresponding to a source address is functional.

36. The system of Claim 35 wherein the logic means is configured to suppress the transmission means from transmitting a data frame to a node corresponding to a functional transmission medium until after a predetermined first number of intervals expire.

37. The system of Claim 35 wherein the data frame comprises a data-layer header that includes the address.

38. The system of Claim 37 wherein the data frame includes a message.

39. The system of Claim 37 wherein the data frame further comprises a destination address.

40. The system of Claim 39 wherein the destination address is a broadcast address.

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41. The system of Claim 39 wherein the destination address is a multicast address.

42. The system of Claim 35 wherein the connections are from the group of telephone wire, shielded twisted pair, unshielded twisted pair, cable, power line, optical fiber, or wireless transmission medium.

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